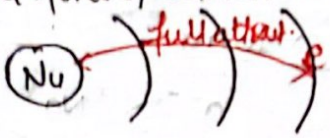
PERIODIC TABLE

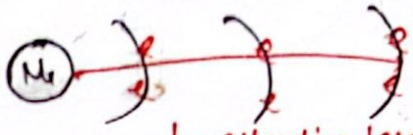
① Atomic Size:-

→ Accurate value of atomic size can't be measured.
└ due to isolated atom doesnot exist.

→ 
electron in wave path → effect of adjacent atom.
→ electron cloud doesnot have well defined boundary.

$Z_{effective}$ → Net force of attraction on valance e^-.





└ attraction less force ઘટ્ટ.

Period →
Zeff ↑ size ↓es.

group ↓
size ↑es (addition of shell).
Zeff

$\boxed{M^- > M > M^+}$ — atomic size.

+ve charge ↑es → size ↓es.
-ve charge ↑es → size ↑es.

→ $\boxed{I^- > I > I^+}$ — cation is always smaller than metal ion.

Q. Size ↓esing order:—

→ $\boxed{Mn > Mn^{+2} > Mn^{+4} > Mn^{+7}}$

$\boxed{\text{Cationic radii} \propto \frac{1}{+\text{ve charge}}}$

Q. In which compound size of Fe is maximum.

ⓐ $\overset{+2}{Fe}SO_4$ ⓑ $\overset{+2}{Fe}SO_4.7H_2O$ ⓒ $K_3[\overset{+3}{Fe}(CN)_6]$

ⓓ $\overset{0}{Fe}(CO)_5$ └ neutral. ⓔ $[\overset{+1}{Fe}(H_2O)_5NO^{+1}]SO_4$.

size $\propto \frac{1}{+\text{ve charge}}$. ∴ $\boxed{d > e > b > a > c}$

→ Anion is always larger than parent atom.

$\boxed{F < F^-}$ $\boxed{O^{--} > O^- > O}$

size ↓es
P. due to Zeff ↑es / shell no. constant. → charge ↑es.

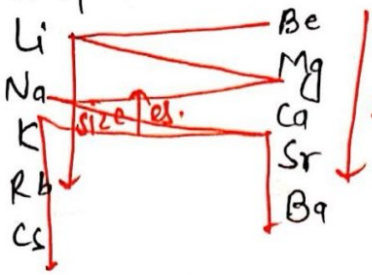
G. Size ↑es.
└ due to addition of shell.

→ Size → Ne > Li > Be > B > C > N > O > F. → along period.
Noble gas.
└ more due to vanderwaals radius.

3rd period → Ar > Na > Mg > Al > Si > P > S > Cl

Ar → Noble gas, vander waal radius

1A Groupe →



for isoelectronic species – same e⁻.

$O^{-2} > Na^{+}$

10e⁻ 10e⁻

size ∝ 1 / atm no.

Q. $N^{-3} > O^{-2} > F^{-} > Na^{+} > Mg^{+2}$

└ isoelectronic.

Q. $Na^{+} < Mg^{+}$.

2,8 2,8,1.

└ more shell.

Q. $Na^{+} > Mg^{++}$

2,8 2,8.

isoelectronic.

Q. size की decreasing order →

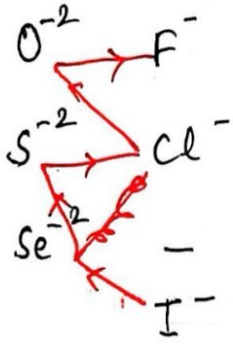
→ $P^{-3} > S^{--} > Cl^{-} > K^{+} > Ca^{+2}$

18e⁻ 18e⁻ 18e⁻ 18e⁻ 18e⁻

Q. Neon is larger than:- (Neon → Noble gas.)

(a) F (b) He (c) Li (d) All

Q. size की Increasing order →



→ $I^{-} > Se^{-2} > S^{-2} > Cl^{-} > O^{-2} > F^{-}$

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13th group - Boron family

B

Al] more of Al than Ga.

Ga] size less than Al becau of poor shielding of $3d^{10}e^-$.

In

Tl.

Ga → $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^1$.

(31) - $1s^2\ 2s^2\ 2p^6\ \boxed{3s^2\ 3p^6\ 3d^{10}}\ 4s^2\ 4p^1$

↳ poor shielding

↳ $10e^-$ ↳ chinese electron

so, force of attraction ↑es. so, size ↓es.

- radi of Al > Ga → due to poor shielding of 3d subshell.

- Correct order of radii?

(a) B < Al < Ga < In < Tl

(b) B > Al > Ga > In < Tl

(c) B < Al > Ga > In > Tl

(d) None

— Ans is ↳ $\boxed{B < Al > Ga < In < Tl}$.

a. $\boxed{B < Ga < Al < In < Tl}$

167 170.

लगभग बराबर

14th family → Carbon faimily.

C

Si

Ge

Sn

Pb.

size ↑es.

↳ no exp.

- 3d series / 1st transition series :-

IIIB IVB VIB VIIB VIIIB VIII IB IIB

Sc, Ti, V, Cr, Mn, < Fe, Co, Ni, < Cu, Zn.

(almost same)

$Z_{eff} > \sigma$. ↳ screening effect.

$Z_{eff} \approx \sigma$

$Z_{eff} < \sigma$.

- 4d series / 2nd T.S.

39 40

Y Zr Nb - - - - - - - - - - Pd Ag Cd.

57 72

3rd T.S La Hf Ta - - - - - - - - - Pt Au Hg

104

Ac Rf - - - - - - -

89 58 71

Ce Cu

- Th - Lr → 5F series

↳ f-block / 4f-series.

F subshell मा भएको e^-

↓

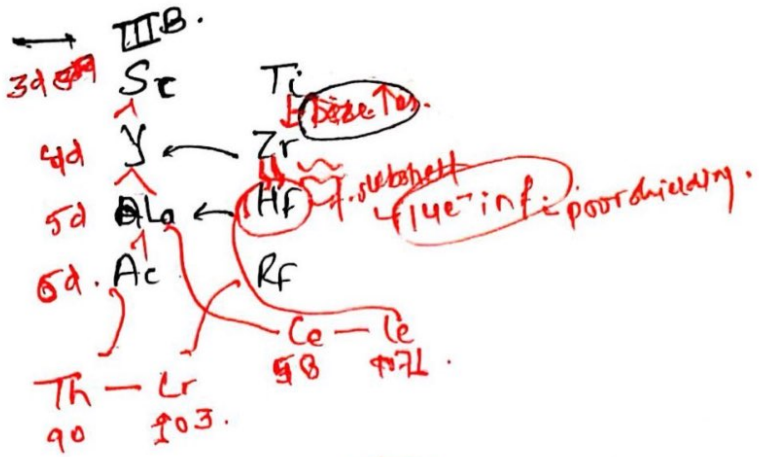
chinese electron

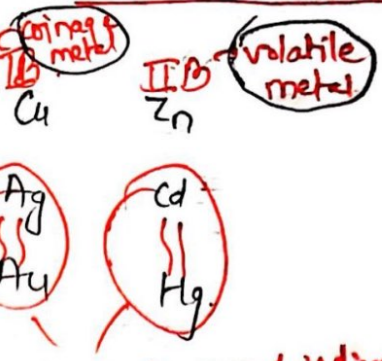
↓

poor shielding

Zr ≃ Hf → due to poor shielding of 4f electron.

↳ called lanthanide contraction.





also due to poor shielding of e⁻.
↓
lanthanide contraction.

3d < 4d

4d ≃ 5d — due to lanthanide contraction.

Al > Ga → 3d¹⁰ poor shielding.
↳ Transition contraction

$Zr^{+4} \simeq Hf^{+4}$.

→ Ti < Zr ≃ Hf.

Q. Which coinage metal have same size?

(a) Cu, Ag (b) Cu, Au (c) Ag, Au (d) None

Cu < Ag ≃ Au
3d 4d 5d.

Q. Which pair has almost same size?

(a) Fe, Co (Zeff = σ). (b) Al, Ga — 3d shield. (c) Zr, Hf — lanthan. cont. (d) Li, Mg — diagonal relationship. (e) All

In to Tl — lanthanide contraction.
↳ but size Tes to by minimum diff.

Q. Which pair has almost same size?

(a) Ti, Zr (b) Zr^{+2}, Hf^{+4} (c) Fe^{+2}, Ni^{+2} — 2nd pri. (d) Zr^{+4}, Hf^{+4} — 1st pri.

Q. Arrange the following in order of decreasing order of atomic radii.
Na, Al, Ar, Cl.

(a) Na, Cl, Al, Ar (b) Ar, Cl, Al, Na.

(c) Ar, Al, Cl, Na (d) Ar > Na > Al > Cl

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9. Which of the following is correct?

(a) Ionic rad. is proportional to atm. no.

(b) Ionic rad. is inversely proportional to atm. mass.

(c) Ionic rad. is inversely pr. to eff nuclear charge.
└ atm. size ↑es.

(d) all are correct.

Q. Which is correct arranged in increasing size?

(a) F < O < C < Cl < Br (b) C < O < F < Cl < Br

(c) Cl < Br < F < C < O (d) O < F < C < Cl < Br.

Br > Cl > C > O > F.

Q. Dif. btw S & S^{2-} is that S^{2-} has:-

$S^{2-} > S$

(a) Larger radi & larger size.

(b) smaller radii & large size.

(c) larger radii & small size.

(d) small radii & small size.

Q. Increase in atm. size down the group is due to:—

p^+ ↑es – size ↓es.

(a) increase in no. of e^-

(b) ↑es in no. of p^+ & n^0.

(c) ↑es in no. of p^+

(d) ↑es in no. of p^+, n^0 & e^-.

Q. Arrange in the increasing order of atomic radii of following elements O, C, F, Cl, Br.

(a) F, O, C, Cl, Br (b) F, C, O, Cl, Br

(c) F, Cl, Br, O, C (d) C, O, F, Cl, Br.

Q. In which one of the following pairs the radius of the 2nd species is greater than that of 1st?

(a) Na > Mg (b) $O^{2-} < N^{3-}$ (c) $Li^+ > Be^{+2}$ (d) $Ba^{+2} > Sr^{+2}$.

(e) Al > Be

Q. Which of the following ions has smallest radius?

(a) Be^{+2} (b) Li^+ (c) O^{2-} (d) F^-

1 shell. 2 shell

Q. Which of the following has largest radius?

(a) Mg^{+2} (b) Na^+ (c) O^{2-} (d) F^-

isoel. $\propto \frac{1}{\text{atm no.}}$

Q. Among the following, which one has highest cation to anion size ratio?

(a) CsI (b) CsF (c) LiF (d) NaF

$\frac{C}{A}$ = more

Q. Identify the correct order of size of the following:-

(a) $Ca^{+2} < Ar < K^+ < Cl^- < S^{2-}$

(b) $Ca^{2+} < K^+ < Ar < S^{2-} < Cl^-$

(c) $Ca^{2+} < K^+ < Ar < Cl^- < S^{2-}$

(d) $Ar < Ca^{+2} < K^+ < Cl^- < S^{2-}$

isoel. size $\propto \frac{1}{\text{atm no.}}$

Q. The ionic radii (A°) of C^{4-} & O^{2-} resp. are 2.60 & 1.40. The ionic radius of isoel. ion N^{3-} would be:-

Can no. less.

(a) 2.6 (b) 1.71 (c) 1.4 (d) 0.95

Q. The correct order of increasing radii of the ions Br^-, F^-, O^{2-} & S^{2-} is:-

→ $Br^- > S^{2-} > O^{2-} > F^-$

(a)

Q. The correct sequence which shows decreasing order of ionic radii of the element:-

(a) $Na^+ > F^- > Mg^{2+} > O^{2-} > Al^{+3}$

(b) $O^{2-} > F^- > Na^+ > Mg^{+2} > Al^{+3}$

(c) $Al^{+3} > Mg^{+2} > Na^+ > F^- > O_2^-$

isoel. size $\propto \frac{1}{\text{atm no.}}$

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2. Ionisation Energy / Enthalpy potential

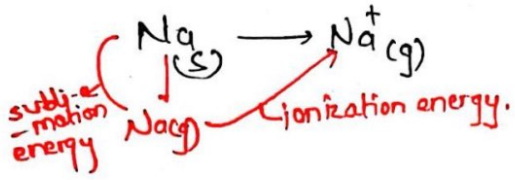
→ Amount of energy required to remove losely held e^- from isolated gaseous state/atom.

no repulsion acting
no force of attract
कसैको interaction नभाएको

$$Na_{(s)} \longrightarrow Na^+_{(g)}$$

sublimation energy

$Na_{(g)}$ → ionization energy.



$$Na_{(g)} \xrightarrow{I.E} Na^+_{(g)} + e^-$$

2, 8, 1   2, 8

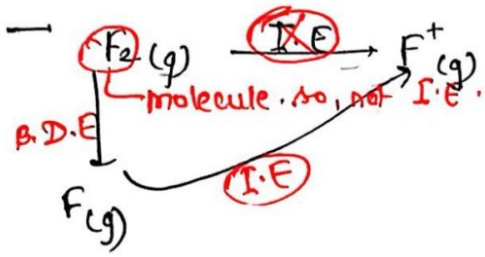
→ It is always endothermic process.

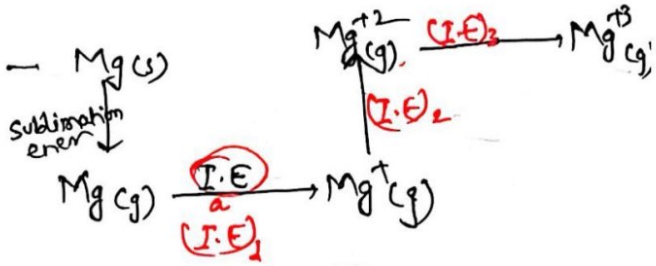
→ unit of I.E → ev/atom, KJ/mole, Kcal/mole.

1ev/atom = 96.4 KJ/mol.

1ev/atom = 23.1 Kcal/mol.

also for electron affinity.
└ same unit.





→ $F_{2(g)} \xrightarrow{I.E} F^+_{(g)}$

└ molecule. so, not I.E.

B.D.E ↓

$F_{(g)}$ → I.E → $F^+_{(g)}$

→ $Mg_{(s)}$

sublimation ener ↓

$Mg_{(g)} \xrightarrow[(I.E)_1]{I.E} Mg^+_{(g)}$

$Mg^+_{(g)} \xrightarrow{(I.E)_2} Mg^{+2}_{(g)} \xrightarrow{(I.E)_3} Mg^{+3}_{(g)}$

Q. → 11p Na $1s^2 2s^2 2p^6 3s^1$ $\xrightarrow[(I.E)_1]{-e}$ 10p Na^+ $1s^2 2s^2 2p^6$ $\xrightarrow[(I.E)_2]{-e}$ 9p Na^{+2} $1s^2 2s^2 2p^5$ $\xrightarrow[(I.E)_3]{-e}$ 8p Na^{+3} $1s^2 2s^2 2p^4$.

(a) $(I.E)_1 > (I.E)_2 > (I.E)_3$

(b) $(I.E)_2 > (I.E)_3 > (I.E)_1$

(c) $(I.E)_2 > (I.E)_1 > (I.E)_3$.

(d) $(I.E)_3 > (I.E)_2 > (I.E)_1$

[successive ionisation energy of any particular energy always ↑es.]

Q. Correct order of I.E.

(a) $(I.E)_n > (I.E)_{n-1}$ (b) $(I.E)_n < (I.E)_{n-1}$

(c) $(I.E)_n = (I.E)_{n-1}$ (d) None.

$n = 5$
$n-1 = 4$
└ s(I.E) always ↑

Factors affecting I.E

① No. of proton ↑es → (I.E) ↑es. due to attraction ↑es with proton.

② Effective nuclear charge (Z_{eff}) ↑es → (I.E) ↑es.
└ attraction

③ Shell ↑es → (I.E) ↓es.
└ attraction होटल.

④ Shielding (σ) ↑es → (I.E) ↓es.
└ attraction होटल

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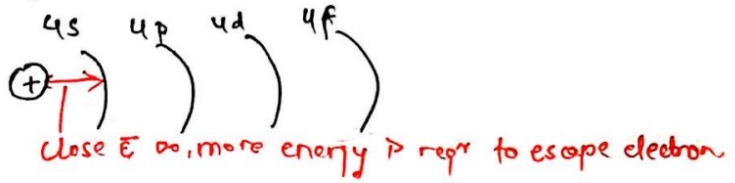
⑤ Half filled & full filled.

⑥ Penetration effect: closeness towards nucleus.



Q. Ionisation energy / potential not depend on :—

ⓐ Size (inverse relation) ⓑ Z_{eff} ⓒ σ (shielding effect).

ⓓ Bond order (no. of bond).

└ I.P is property of isolated atom.

→ N $1s^2 2s^2 2p^3$ (↑ ↑ ↑) > O $1s^2 2s^2 2p^4$ (↑↓ ↑ ↑)

Half filled └ more energy reqr.

→ P $3p^3$ > S $3p^4$.

→ As $4p^3$ (half filled) > Se $4p^4$

Trends along period

2nd period → Li, Be (full filled), B, C, N (half filled), O, F, Ne

(Z_{eff}) ↑es attraction ↑es, (I.E) ↑es.

└ Li < B < Be < C < O < N < F < Ne

Q. Which has highest I.E.

ⓐ $1s^2 2s^2 2p^2$ C ⓑ $1s^2 2s^2 2p^3$ N

ⓒ $1s^2 2s^2 2p^4$ O ⓓ $1s^2 2s^2 2p^5$ f

F > N > O > C

3rd period

└ Na < Al < Mg < Si < S < P < Cl < Ar

4th period.

└ K < Ca (calcium) < Ga < Ge < Se < As < Br < Kr

Note:— Noble gas has highest I.E in their respective period.

— Alkali metal has lowest I.E.

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→ He has highest I.E in periodic table.

He — max I.E
Ne
Ar
Kr
Xe — decreases

Q. Which of the following order of I.E is correct?
(a) Mg > Si (b) Ca > Ge (c) N > O (d) All

Q. Which is correct for I.E ?
(a) P > S (b) As > Se (c) Be > B (d) All

→ Li Be B C N O F Ne — $(I.E)_1$.
I
2nd period Li^+ Be^+ B^+ C^+ N^+ O^+ F^+ Ne^+ → $(I.E)_2$.
$1s^2$

$(I.E)_2$ → unipositive ion से electron निकालने energy.

→ N < O → $(I.E)_2$.
$2p^2$ $2p^3$ half filled.

- 2nd I.E of 2nd period

Be < C < B < N < F < O < Ne < Li

- 2nd I.E of 3rd period → Mg < Si < Al < P < Cl < S < Ar < Na.

Q. Na —(a)→ Na^+ —(b)→ Na^{+2} — noble gas config.
Mg —(c)→ Mg^+ —(d)→ Mg^{+2} — not noble gas conf. Which is correct.
(a) a < b (b) c < d (c) a < c (d) b > d (e) All
Na < Mg.

Q. A → A^+ 10 eV $(I.E)_1$.
A^+ → A^{+2} 12 eV $(I.E)_2$
A^{+2} → A^{+3} 14 eV $(I.E)_3$
A^{+3} → A^{+4} 140 eV $(I.E)_4$, sudden jump. Noble gas config.
A^{+3} — noble gas.

find:-
Valance e⁻ of A → 3
O.S. of A → +3
group of element A in PT → IIIA or 13.
p-block. — Boron family

Q. Which of the following has highest I.E?

(a) $Ne > Ne^+$ (b) $Ne^+ > Ne$ (c) $Ne^+ = Ne$ (d) None

Noble gas full filled

because successive I.E always ↑es.

Q. $(I.E)_1$ of Na is 5.4 eV. The $(I.E)_2$ of Na is:-

Na^+ Noble gas cof Na^{+2}

(a) 10 (b) 5 (c) 5.4 (d) 97.

→ Ne < Na^+

$1s^2 2s^2 2p^6$ $1s^2 2s^2 2p^6$ size ↓es I.E ↑es

10 e^- 10 p. 10 e^- 11 p. → more attraction so, more amt of energy reqr.

Q. Ti V Cr Mn → order of $(I.E)_2$ is:-

$3d^2 4s^1$ $3d^3 4s^1$ $3d^5$ $3d^5 4s^1$

half fi.

↳ $Cr^{+1} > Mn^{+1} > V^{+1} > Ti^{+1}$

size ↓ less than Ti

Q. C Mn Fe → order of $(I.E)_3$ is:-

$3d^4$ $3d^5$ $3d^6$.

↳ $Mn^{+2} > Fr^{+2} > Cr^{+2}$

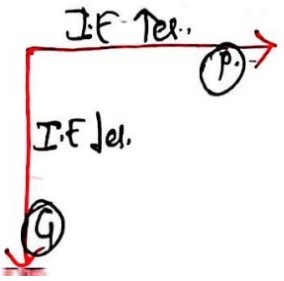
Q. I.E को ↓es order Be He N Ne.

↳ He > Ne > N > Be

→ Ar > Cl > P > Si — $(I.E)_1$

Q. $(I.E)_2$ को ↓es order Si Na Mg Al.

↳ $Na^+ > Al^+ > Si^+ > Mg^+$. — $(I.E)_2$.



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Q. Which configuration has highest I.E ?

(a) [Ne] $3s^2 3p^1$ (b) [Ne] $3s^2 3p^3$

(c) [Ar] $3d^{10} 4s^2 4p^5$ (d) [Ne] $3s^2 3p^2$

$3p^3$, $4p^3$ ↓ decrease group

b > c.

I.E in Group

IA ↓ size ↑es. I.E ↓es.

IIA ↓ size ↑es. I.E ↓es.

IIIA (Boron family). ↳ family of exception

B

Al → $1s^2 2s^2 2p^6 3s^2 3p^1$

Ga → 31 → $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ $3d^{10}$ → de^- → chinese e^-

In

Tl → $4Fe^-$

So, Ga > Al & Tl > In.

due to $3d\ e^-$ due to $4Fe^-$

B > Al < Ga > In < Tl

Carbon family

C

Si

Ge → C > Si > Ge > Pb > Sn

Sn

Pb $4F^1$

→ 'd' block

3d → 1st tr. series. Sc Ti V Cr Mn Fe Co Ni Cu Zn.

↓ I.E ↓es. ↓ I.E ↓es.

4d → 2nd tr. ser Y Zr Nb - - - - - Pd Ag Cd.

↓ I.E ↑es.

5d → 3rd transition series. La HF 72 due to strong attraction. Pt Au Hg. 80

14 elements जसले गडबड गर्दि

Ti > Zr but HF > Zr. but in Ti < HF

- I.E of → ~~Zn > Hg > Cd.~~

→ Zn > Cd < Hg.

5d series > 3d > 4d (I.E).

Hg > Zn > Cd.

5d 3d 4d.

5d > 4d. ↳ due to lanthanide contraction or poor shielding.

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Q. Which coinage metal has min. IP?

(a) Cu (3d) (b) Ag (4d) (c) Au (5d) (d) Hg (5d)

→ ~~Ag~~ Au > Hg > Cu > Ag.

Q. Which IV A has min IP.?

→ C > Si > Ge > Pb > Sn

Bcz of poor shielding of 4f e⁻ (chinese e⁻)

→ Max. I.P → He
Min I.P → Cs.

Q. Which of the following order of I.E is correct?

(a) Cu < Ag < Au. (b) Cu < Ag > Au. (c) Cu > Ag < Au

(d) None.

(3d) (4d) (5d)

Cu < Au & Cu > Ag.

~~Ag > Cu~~, 5d > 3d > 4d.

Au > Cu > Ag.

Application of Ionisation potential

(I) Metallic Character: Readily lose electron.

M.C. ∝ 1/I.E

Li 2s¹
Cs 6s¹

↓ I.P ↓, M.C ↑es.

more in s-block than d-block.

IA more than IIA.

Q. Which configuration show maximum metallic character?

(a) [He]2s¹ (b) [Ar]3d¹⁰4s¹ (Cu) (c) [Xe]6s² ~~(d)~~ [Xe]6s¹

(II) Reactivity:-

Reactivity ∝ 1/I.P.

→ Reactivity of s-block metal ↑es down the group because I.P ↓es.

→ Be → stem
Mg – Hot water
Ca, Sr – cold water
} rxn ↑s ↓ I.E↓ R ↑es.

- Li - gentle
  Na - vigrous
  K, Rb, Cs - Highly explosive
  with cold H_2O.

- In which group reactivity ↑es?

(a) IA (b) VII.A (c) Both (d) None

IA: Li, Na, K, Rb, Cs most react.

VII.A: F_2 - Highly rxtive element, Cl_2, Br_2, I_2

(III) To find out valance electron

- I.P ↑es abnormally when e^- lost from stable inert gas configuratio

Q. I.P: 5 (I) → 10 (II) → 15 (III) → 20 (IV) → 120 (V) → 130 (VI) → 145 (VII). Then element.

($1e^-$, $1e^-$, $1e^-$, $1e^-$ sudden jump.)

(a) Na (b) Ca (c) Si (d) AL.

V.S → $4e^-$.

$4e^-$ निकलो पहि sudden jump. so, C family.

Q. If IP are: 5, 75, 80, 90, es. Then metal is:-

($1e^-$ sudden jump)

(a) Li (b) Mg (c) Na. (d) None

$1e^-$ → Alkali metal.

4 I.P निकलो है. so, Li has only $3e^-$.

Note: In Lithium, $(I.P)_4$ not possible.

Q. In which configuration large difference between $(I.P)_2$ & $(I.P)_3$.

($2e^-$ sudden jump.)

(a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$

(b) $1s^2\ 2s^2\ 2p^6\ 3s^1$

(c) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

(d) $1s^2\ 2s^2\ 2p^6\ 3s^2$ — Alkaline earth metal. IIA

- Basic strength of oxide and hydroxide $\propto \frac{1}{I.P}$

LiOH, NaOH, KOH, CsOH — I.P ↓es, Basic ↑es.

Li_2O, Na_2O, K_2O, Cs_2O — I.P ↓es, Basic ↑es.

strongest base in chemistry.

S block > d bl

IA > IIA

basicity

Q. order of Basic strength of CaO, FeO, K_2O.

$K_2O > CaO > FeO$

→ Non-metal को oxide → acidic.
→ Metal को oxide → basic.

Q. Basic strength ↓es order:-

CaO Cs_2O CO_2 (acidic) NiO TiO K_2O.

→ $Cs_2O > K_2O > CaO > TiO > NiO > CO_2$.

Ti — — Ni
I.P ↓es period.

Q. Basic strength order of $\overset{+2}{FeO}$ & $\overset{+3}{Fe_2O_3}$.

$FeO > Fe_2O_3$.

Basic of. $\propto \frac{1}{O.S.}$

→ $\overset{+2}{MnO} > \overset{+4}{MnO_2} > \overset{+7}{Mn_2O_7}$

Q. The Incorrect statement among the following is:-
(a) The 1st I.P of Al is less than 1st I.P of Mg.
(b) The 2nd I.P of Mg is greater than 2nd I.P of Na. incorrect
(c) The 1st I.P of Na is less than the 1st I.P of Mg.
(d) The 3rd I.P of Mg is greater than 3rd I.P of Al.

Q. Lowest ionisation enthalpy in periods is shown by:-
(a) inert gases (b) Halogens (c) Alkali metals (d) alkaline earth metals

Q. Atoms of which of the following groups lose electron most easily?
(a) Li, Na, K (b) Cl, Br, I (c) O, S, Se (d) N, P, As.

Q. The max. io. Enthalpy in period is shown by:-
(a) Alkali metals (b) Inert gases
(c) representative elements (d) Halogens

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Q. Ionisation energy of ~~nitrogen~~ is more than oxygen because :-

(a) nucleus has more attraction for e^-.

(b) Half filled p orbitals are more stable.

(c) Nitrogen atom is small.

(d) more penetration effect

Q. Among the following elements whose electronic conf. are given below the one having highest I.E is :-

(a) $[Ne]3s^2 3p^1$ (b) $[Ne]3s^2 3p^3$ (c) $[Ne]3s^2 3p^2$ (d) $[Ar]3d^{10}4s^2$

Q. A sudden jump between the values of 2nd & 3rd I.E of the elem would be associated with the ele. configuration?

(a) $1s^2, 2s^2 2p^6 3s^1$ (b) $1s^2 2s^2 2p^6 3s^2 3p^1$

(c) $1s^2 2s^2 2p^6 3s^2 3p^2$ (d) $1s^2 2s^2 2p^6 3s^2$ — IIA.

Q. The lanthanide contraction is responsible for the fact that :-

(a) Zr & Y have about the same radius.

(b) Zr & Nb have similar oxdn state

(c) Zr & Hf have about same radius

(d) Zr & Zn has same oxdn state

Q. Increasing order of density is :- $d = m/v$. ↓ Na, K.

(a) Li < K < Na < Rb < Cs

(b) Li < Na < K < Rb < Cs.

(c) Cs < Rb < K < Na < Li

(d) K < Li < Na < Rb < Cs.

Q. order E.C. of K, Cu & Cr are respectively :-

(a) $4s^1, 3d^{10}, 3d^5$

(b) $4s^2, 3d^{10}, 3d^1$

(c) $4s^1, 3d^9, 3d^4$

(d) $4s^2, 3d^9, 3d^4$.

Q. Identify the correct order of the size of following :-

(a) $Ca^{+2} < K^+ < Ar < Cl^- < S^{2-}$

(b) $Ar < Ca^{+2} < K^+ < Cl^- < S^{2-}$

(c) $Ca^{+2} < Ar < K^+ < Cl^- < S^{2-}$

(d) $Ca^{+2} < K^+ < Ar < S^{-2} < Cl^-$

18 e^- — size $\propto \frac{1}{\text{atm no}}$ — isoel. sp.

Q. Which of the following ele. conf. has lowest I.E?

(a) $1s^2\ 2s^2\ 2p^3$ (b) $1s^2\ 2s^2\ 2p^6\ 3s^1$ – alk. metals. ↳ lowest.

(c) $1s^2\ 2s^2\ 2p^6$ (d) $1s^2\ 2s^2\ 2p^5$

Q. The E.C of the atom having maximum dif in 1st & 2nd I.E is:- ↳ Alkali

(a) $1s^2\ 2s^2\ 2p^6\ 3s^1$ (b) $1s^2\ 2s^2\ 2p^6\ 3s^2$

(c) $1s^2\ 2s^2\ 2p^1$ (d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

Q. Which of the following has lowest I.E?

(a) Oxygen (b) Nitrogen (c) Fluorine (d) Sulphur

O < N < F
S
Cl

Electron Affinity

→ Amount of energy released / Absorb. when isolated gas atom gain an e^-.
mostly. ↳ sometimes.

$X_{(g)} + e^- \longrightarrow X^-_{(g)}$ EA/(EA)$_1$ ↳ exothermic generally.
(EA)$_1$ – endothermic sometimes
↳ (EA)$_2$ ... (EA)$_n$ ↳ always endothermic

$X_{(g)} \xrightarrow{-e} X^+_{(g)}$ I.E ↳ always endothermic

Q. In which reaction more energy is released.

(a) $X_{(g)} + e^- \rightarrow X^-_{(g)}$ (EA) – rel. (c) $X_{2(g)} + e^- \rightarrow X^-_{(g)}$ – BDE + E.A
abs. Rel.

(b) $X_{(g)} + e^- \longrightarrow X^-_{(g)}$ ↳ (E.A + H.E) (d) Same in all.
Rel Rele.

b > a > c

$X^-_{(g)} + e^- \xrightarrow{(EA)_2} X^{-2}_{(g)}$.

– $(EA)_2$ is always endothermic because there is a strong repulsion btw anion & incoming e^-. To overcome these repl energy

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Q. In which rxn, energy is released.

(a) $O \xrightarrow{e^-} O^-$ 200 E rel.. (b) $O^- \longrightarrow O^{--}$ $(E.A)_2$ - endoth. always. 800 E abs.. (c) $O \longrightarrow O^{--}$ 600 E abs orb. (800 - 200) (endothermic). always. (d) All.

Note:- Formation of poly-ve ion $X^{-2}/X^{-3}/X^{-4}$ ... is always endothermic because in remaining steps due to strong repulsion, large energy is absorb.

Q. In which reaction, energy is released?

(a) $He \longrightarrow He^-$ (b) $Ar \longrightarrow Ar^-$

(c) $Be \longrightarrow Be^-$ (d) $H \longrightarrow H^-$

Q. (a) $C \longrightarrow C^-$ (b) $O \longrightarrow O^-$

(c) $N \longrightarrow N^-$ half filled - stable. (d) $Ar \longrightarrow Ar^-$

Q (a) $H_2 \xrightarrow{B.D.C.} H$ abs. (b) $Mg_{(s)} \xrightarrow{S.E} Mg_{(g)}$ abs.

(c) $Na_{(g)} \xrightarrow{I.E} Na^+_{(g)}$ (d) $P \longrightarrow P^{-3}$ abs. (e) $S^- \longrightarrow S^{-2}$ abs.

(f) $C^{-2} \longrightarrow C^{-4}$ abs. (g) $Ar \longrightarrow Ar^-$ stable. (h) $Mg \longrightarrow Mg^-$ stable. absorb.

(i) $O \longrightarrow O^-$ release (d) $F \longrightarrow F^-$ more energy release than $O \rightarrow O^-$

→ $X_{(g)} \xrightarrow{+e^-} X^-_{(g)} \xrightarrow{+e^-} X^{--}_{(g)}$

energy release mostly. energy absorb / reqr.

→ $X_{(g)} + e^- \underset{I.E.}{\overset{E.A}{\rightleftharpoons}} X^-_{(g)}$ [E.A of $X_{(g)}$ = I.E of $X^-_{(g)}$]

→ $X_{(g)} \underset{E.A.}{\overset{I.E}{\rightleftharpoons}} X^+_{(g)}$ [E.A of $X_{(g)}$ = E.A of $X^+_{(g)}$].

→ electron affinity of neutral atom = Ionisation E. of its anion.

→ I.E of neutral atom = E.A of its cation

Q. $M_{(g)} \xrightarrow{-e^-} M^+_{(g)} \xrightarrow{+e} M_{(g)}$

energy reqr. (I.E) X_1 — energy relea. (E.A) X_2

(a) $X_1 = X_2$ (b) $X_1 > X_2$ (c) $X_1 < X_2$ (d) None

Q. $X_{(g)} \xrightarrow{+e^-} X^-_{(g)} \xrightarrow{-e^-} X_{(g)}$

energy rel. (EA of X atom) — (I.E) of X^- ion energy reqr.

Q. F & F^- ion →

I.E → $F > F^-$

E.A →

Q. Cl & Cl^+ →

I.E → $Cl^+ > Cl$.

– EA of S > O, Cl > F.

Q. I.E of F^- & Cl^-.

→ $Cl^- > F^-$.

[I.E of F^- = EA of F].

[I.E of Cl^- = EA of Cl]

∵ EA of Cl > EA of F.

So, I.E of $Cl^- > F^-$.

Q. correct order of I.E is:-

(a) $Cl > Cl^- > F^- > F$ (b) $Cl > Cl^- > F > F^-$

(c) $F > Cl > Cl^- > F^-$ (d) $Cl^- > F^- > F > Cl$.

neutral I.E > anion I.E

$F > F^-$.

– EA of X^{+2} = I.E of X^+.

I.E → F > Cl

E.A → Cl > F

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: Change in enthalpy of process in gaseous isolated atom accepts one e^- into valance shell is called electron gain enthalpy (ΔH_{eg}).

$X_{(g)} + e^- \longrightarrow X^-_{(g)}$ ΔH_{eg} = energy rel. (-ve)

Q. $X + e^- \longrightarrow X^-$ $\Delta H_{eg} = -80$ Kcal. — more.

$Y + e^- \longrightarrow Y^-$ $\Delta H_{eg} = -50$ Kcal. — less.

-ve sing only denotes energy release

$\therefore$ X = Cl. Y = F.

Factors affecting E.A

1) E.A $\propto Z_{eff}$

$Z_{eff}\uparrow$ E.A$\uparrow$ → period.

2) EA of elements having Full filled or half Filled.

└ E.C is very less or so for these elements e.gain enthalpy will be +ve. └ endothermic

e.g. Noble gases (full filled), Be, Mg, N (p^3 — half filled). $+e^- \rightarrow$ endothermic not exothermic.

- In which process energy is absorbed?

(a) $N \rightarrow N^-$ (b) $P \rightarrow P^-$ (release. └exo.) (c) Both (d) None

Correct order of E.A.

(a) O > S > Se > Te (b) S > O > Se > Te

(c) S > Se > Te > O (d) O > S > Te > Se.

O, S → S > O (least. most.), Se, Te

→ Cl > F > Br > I

Q. In the formation of chloride ion, from an isolated gaseous Cl atom 3.8 eV energy is released. which would be equal to:-

(a) electron affinity of Cl^- ↳ Cl. (b) I.P of Cl.

(c) Electronegativity of Cl (d) I.P of Cl^-

$Cl + e^- \longrightarrow Cl^-$. [I.P of Cl^- = EA of Cl]

$\boxed{\Delta H_{eg} = -E.A}$.

ΔH_{eg} = +ve → energy reqr. $(E.A)_1$ = +ve — exo, released.

ΔH_{eg} = -ve → energy released. $(E.A)_1$ = -ve — endo, absorbed.

• Noble gases, N, Be, Mg has +ve ΔH_{eg} & -ve $(E.A)_1$.
endo. endo.

→ $(EA)_2$ always endothermic.

Trend in E.A

period
E.A ↑es with few exp.

group
EA ↓es with few exept.

$\boxed{Be \quad N \quad Ne}$ — endothermic.

2nd period → Li Be (s^2 — leat than N.) B C N (p^3) O F Ne — least E.A. stable most.

↳ $\boxed{Ne < Be < N}$ endo.

— $Ne < Be < N < Li < B < C < O < F$ ($B < Li$)

$Li + e^- \rightarrow 1s^2 2s^2$ — leat the B full fi.

↳ $\boxed{Ne < Be < N < B < Li < C < O < F}$

3rd period

→ Na Mg Al Si P S Cl Ar

$\boxed{Ar \text{ \& } Mg \rightarrow \text{endothermic}}$

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→ Ar < Mg < Na < Al < Si < S < Cl

endothermic

→ Ar < Mg < Al < Na < P < Si < S < Cl

- In halogen family → Cl > F > Br > I
- In oxygen family → S > Se > Te > O
- In carbon family → Si > C. P > N.

Q. which ion is least stable:-
(a) Li^- (b) C^- (c) O^- (d) Be^- → $1s^2 2s^2 2p^1$ unstable.
($2s^2$)

→ 1st period → H > He
↳ E.A ↓es.

Q. In the formation of chloride ion, from an isolated gaseous atom, 3.8 eV energy is released. Which would be equal to;-
(a) EA of Cl^- (b) I.P of Cl^- (c) EN of Cl^- (d) I.P of Cl.

Q. The correct order of E.A is:-
(a) Be < B < C < N (b) Be < N < B < C (c) N < Be < C < B
(d) N < C < B < Be

Q. In which of the following process maximum amount of energy involved
(a) $Cl \rightarrow Cl^-$ (release maxm.) (b) $Br^- \rightarrow Br$ (IP of Br^- = EA of Br) (c) $F^- \rightarrow F$ (maxm amount of energy require.) (d) $I^- \rightarrow I$

Q. Which of the following statement is correct?
(a) 1st IP of N is greater than O^+ (sp^3, sp^2; more IP due to more nuclear charge.)
(b) 1st I.P of N is equal to O^+.
(c) 1st I.P of N is less than O^+.
(d) The EA of N is greater than O^+.
↳ less.

Q. Choose the correct order of the property given below:-

(a) $N^{3-} < O^{2-}$: ionic radius (Noel $N^3 > O^{2-}$) (b) $N > O$: 1st I.E

(c) $N > O$: 2nd I.E (d) $N > O$: E.A order

$N < O$.

Q. Which of the following are correct?

(a) 1st I.E of $N > O$ (b) 2nd I.E of $O > N$

(c) 1st E.A of $N < O$ (d) 1st E.A of $Be < Be$

(A) a, b (b) a & c (c) I, II, III (d) All

Q. Which of the following would require least energy?

(a) $Si^-_{(g)} \longrightarrow Si_{(g)} + e^-$ (b) $P^-_{(g)} \longrightarrow P_{(g)} + e^-$

(c) $S^-_{(g)} \longrightarrow S_{(g)} + e^-$ (d) $Cl^-_{(g)} \longrightarrow Cl_{(g)} + e^-$

E.A of X = I.E of X

P least

Q. Correct order of E.A ?

(a) $O < S < F < Cl$ (b) $O < F < S < Cl$

(c) $F < O < Cl < S$ (d) $F < Cl < O < S$.

$Cl > F > S > O$

Q. Which of the following has lowest E.A?

(a) O (b) S (c) F (d) Cl

Q. The incorrect order of E.A?

(a) $F < Cl$ (b) $N > F$ (c) $O < S$ (d) $Cl > Br$

Q. The 1st I.P of Na is 5.1 eV. The value of electron gain enthalpy of Na^+ would be:-

(a) -2.55 eV (b) -5.1 eV (c) -10.2 eV (d) 2.55 eV.

Q. The least stable anion is:-

(a) Li^- (b) Br^- (stable in Br) (c) B^- (d) C^-

Q. The increasing order of E.A is:-

(a) $N < O < Cl < Al$ (b) $O < N < Al < Cl$

(c) $Al < N < O < Cl$ (d) $Cl < N < O < Al$

Q. Correct order of I.P ?

(a) $F^- > F > Cl^- > Cl$ (b) $F > Cl > Cl^- > F^-$

(c) $F^- > Cl^- > Cl > F$ (d) $F^- > Cl^- > F > Cl$

$F > F^-$

$Cl > Cl^-$

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Q. Which of the following species has maximum tendency to accept electron cloud?
Less charge
(a) O^{2-} (b) O^{-1} (c) O^{+1} (d) O^{+2}.

Q. Select the correct order of electron affinity?
(a) $F^- > Cl^-$ (b) $F > Cl$ (c) $Cl > F$ (d) $F^- > F$

Q. The numerical value of energy involved in the given process: $S \rightarrow S$ is less than, which of the following process: -
(a) $S^+ \rightarrow S$ (b) $Se \rightarrow Se^-$ (c) $S \rightarrow S^+$ (d) B & C both.

Q. Which of the following process is exothermic?
(a) $P \rightarrow P^+$ (b) $P \rightarrow P^-$ (c) $P^+ \rightarrow P$ (d) $P^+ \rightarrow P^{+2}$.

Q. Which is correct order of E.A?
(a) Li < Be (b) B > B (c) Li > B (d) Li > C.

Q. Which element has highest E.A?
(a) Be (b) B (c) Li (d) C.

I.E of Neutral atom > anion
cation > neutral atom

Q. Which of the following is exothermic?
(a) $N_{(g)} + 1e^- \rightarrow N^-_{(g)}$ (b) $P^+_{(g)} + 1e^- \rightarrow P_{(g)}$
(c) $Na_{(g)} \rightarrow Na^+_{(g)} + 1e^-$ (d) $1e^- + Be^+_{(g)} \rightarrow Be^-_{(g)}$.

Q. Incorrect order of E.A?
(a) Li < Na (b) Al > B (c) Si > C (d) Cl > F.
3s 4p
more

Q. Maxm E.A?
(a) C (b) Si (c) N (d) P
Si > C.
Si > P.

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Electronegativity

→ The tendency of an atom in a molecule to attract shared pair e^- towards itself is called E.N.

· Arrhenious base → LiOH, NaOH, KOH, RbOH, CsOH,

g वटा.

$Be(OH)_2$ & $Mg(OH)_2$ $Ca(OH)_2$, $Sr(OH)_2$, $Ba(OH)_2$, NH_4OH.

ppt बनाउंछ — sp solub.

– Rest metal hydroxides being H_2O insoluble and are not arrhenious base.

→ EN and E.A both have tendency to attract electron but E.A is for isolated atom but E.N is for bonded atom.

Q. I–Cl represent like:-

(a) $\overset{+}{I} - \overset{-}{Cl}$ (b) $\overset{\delta-}{I} - \overset{\delta-}{Cl}$ (c) $I - \overset{\delta+}{Cl}$ (d) $\overset{\delta+}{I} - \overset{\delta-}{Cl}$ more EN.

E.N.	E.A
(i) Tendency of an atom in a molecule to attract bonded e^- towards itself.	(i) Energy released when an e^- is added to neutral isolated gaseous atom.
(ii) Relative value of an atom.	(ii) Absolute value of an atom.
(iii) No unit.	(iii) Measured in ev/atom or KJ/mole or Kcal/mol.

Note:

$\boxed{\text{EN of } F > Cl}$ but. $\boxed{\text{EA of } Cl > F}$.

Factors affecting E.N

① Effective nuclear charge (Z_{eff}):-

Z_{eff} ↑es, EN ↑es. → period

group ↓ EN ↓es. Z_{eff} ↓es.

$\boxed{Mn^{+2} < Mn^{+4}}$ – Z_{eff}.

→ $\boxed{O^{2-} < O^- < O < O^+ < O^{+2}}$ ← Z_{eff}. EN

→ $\boxed{Fe < Fe^{+2} < Fe^{+3}}$.

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② $E.N \propto \frac{1}{size}$. ③ σ (screening constant)

$$\boxed{E.N \propto \frac{1}{\sigma}}$$

→ E.N doesnot depend on stable configuration. but I.E & EA. does.

Q. Which of the following is affected by stable configuration of an atom?

ⓐ E.N (unaffected) ⓑ I.P ⓒ EA ~~ⓓ~~ Both I.P & E.A.

Q. Which of the following will have the most & least negative e^- gain enthalpy?

ⓐ P, Cl ⓑ Cl, F ⓒ Cl, S ~~ⓓ~~ Cl (most), P (least).

→ E.N ↑es with the ↑es in +ve charge. & ↓es with ↑es in -ve charge.

→ E.N. ∝ % S-character.

	CH_4	C_2H_4	C_2H_2
	sp^3	sp^2	sp
% S character	25%	33.33%	50%

E.N ↑es.

→ $\overset{1}{C}H_2 = \overset{2}{C}H - \overset{3}{C} \equiv \overset{4}{C}H_4$.

E.N → $\boxed{C_2 < C_3}$

• $H_2\overset{-2}{O} < H_2\overset{-1}{O_2}$

• $H_2\overset{-1}{O_2} < \overset{+2}{O}F_2$

→ $\boxed{E.N \propto +ve.O.S \propto \frac{1}{-ve.O.S.}}$

H-C≡N

H-bond बनाउछ

Trend of E.N

① down the group, E.N decreases because size ↑es or Zeff ↓es.

F
Cl
Br
I

size ↑es
E.N ↓es.

$\boxed{F > Cl > Br > I}$
↳ EN | I.E | reactivity | O.A.

Q. EN ↓es order: -

S F O Cl

O ← F
S ← Cl

$\boxed{F > O > Cl > S}$

Q. N S O P

N ← O
P ← S

E.N → $\boxed{O > N > S > P}$

$\boxed{I.E \rightarrow N > O > P > S}$ $\boxed{P \approx H}$ - E.N.

$\boxed{E.A \rightarrow S > O > P > N}$ endo lest.

• Exception in IIIA / 13 group / Boron family.

B
Al
Ga

EN ↓es.

E.N of Ga > Al.
due to transition contraction
or
d-orbital contraction.

4d
5d. EN of 5d > 4d
↳ due to lanthanide contraction.

② In period, left to right, E.N ↑es because size ↓es or Zeff ↑es.

• In each period, Halogen has maximum E.N due to its high Zeff. Ne
↳ Bond ৭০।১৩০

Li	Be	B	C	N	O	F
1	1.5	2	2.5	3	3.5	4

Na	Mg	Al	Si	P	S	Cl
0.9	1.2	1.5	1.8	2.1	2.5	3.0

$N \approx Cl \rightarrow 3$
$P \approx H \rightarrow 2.1$
$C \approx S \approx I \rightarrow 2.5$

* Application of E.N

① Nature of oxides

Oxide + H_2O ⟶ metal hydroxide | non-metal oxyacid

- Metal oxides are mostly basic in nature due to their predominant ionic character.

M — O — H

break due to more polar.

$(M-O)_{polar} > (O-H)_{Basic}$

↳ Arrhenius base.

② Non-metallic character

Non-metallic character ∝ E.N.

N, S, O, P.

$O > N > S > P$ ← Non-metallic character

③ Polarity of bond

Polarity of bond ∝ ΔE.N.

H–F
H–Cl
H–Br
H–I

↓ ΔEN ↓es.
so, polarity of bond ↓es.

Q. Which bond is least polar?

(a) NF (b) NI (c) NH (d) N–Cl. $N \approx Cl$.
$3 \approx 3$ ΔEN – least

Q. Arrange various pnicogen hydride in order of ↓es bond polarity.

NH_3 & PH_3 & AsH_3 & SbH_3

$^{3}N - ^{2.1}H$ $\quad$ $^{2.1}P - ^{2.1}H$ $\quad$ $^{1.8}As - ^{2.1}H$ $\quad$ $^{1.7}Sb - ^{2.1}H$

$\Delta EN \approx 0$.

→ $NH_3 > SbH_3 > AsH_3 > PH_3$ ← Bond polarity

Q. P_4O_{10} is dimer of :-

(a) P_2O_3 (b) P_2O_5 (c) both (d) None

Empirical formula.

* Relative basic character of metal oxide $\propto \frac{1}{\text{charge density of metal cation}}$

- $^{+1}Na_2O > ^{+2}BaO$ (basic, basic)
- $^{+1}Li_2O > ^{+2}MgO$ (Basic, Basic)
- $^{+2}SnO > ^{+4}SnO_2$ (ampotoi A/B, Amphot. A/B)
- $^{+2}CaO > ^{+3}Al_2O_3$ (basic, ampho.)
- $^{+2}PbO > ^{+4}PbO_2$ (ampoh., ampl)

- Relative acidic character of non-metal oxide $\propto$ charge density of central atom.

central atom → less in no. & less EN

- $^{+4}SO_2 < ^{+6}SO_3$ (acidic, acidic)
- $^{+5}Cl_2O_5 < ^{+7}Cl_2O_7$
- $^{+3}N_2O_3 < ^{+5}N_2O_5$
- $^{+4}SiO_2 < ^{+4}CO_2$ (size less ← morecha density.)
- ~~Basic~~

→ Basic character $\propto \frac{1}{\text{C. Density of metal cation}}$

→ Acidic character $\propto$ C. Density of central atom.

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Periodic trend of nature of oxide across period

$\overset{+1}{Na_2O}$ S. Basic $\overset{+2}{MgO}$ Basic $\overset{+3}{Al_2O_3}$ amphoteric $\overset{+4}{SiO_2}$ less acidic $\overset{+5}{P_4O_{10}}$ acidic $\overset{+6}{SO_3}$ more acidic $\overset{+7}{Cl_2O_7}$ most acidic

Left to right → Acidic character ↑es.
down the group → Basic character ↑es

- Na_2O, K_2O, Rb_2O, Cs_2O — charge density ↓es. Basic character ↑es.

- PbO amphoteric, MgO, CaO, SrO, BaO — Basic oxide.

↳ $PbO < MgO < CaO < SrO < BaO$ — Basic character

– $\overset{+2}{BeO}$ (ampho) > $\overset{+3}{Al_2O_3}$ (ampho) — Basic character.

- 'd' block cation को Z_{eff} को value s-block भन्दा बढी हुन्छ।

Q. order of acidic character?

– $\overset{+1}{N_2O} < \overset{+2}{NO} < \overset{+3}{N_2O_3} < \overset{+4}{NO_2} < \overset{+5}{N_2O_5}$

(N_2O: neutral)

Q. – $\overset{+1}{Cl_2O} < \overset{+3}{Cl_2O_3} < \overset{+4}{ClO_2} < \overset{+5}{Cl_2O_5} < \overset{+6}{ClO_3} < \overset{+7}{Cl_2O_7}$

→ $\overset{+2}{NO}$ $\overset{+4}{SiO_2}$ $\overset{+4}{SO_2}$ $\overset{+4}{CO_2}$

acidic ↳ $SO_2 > CO_2 > SiO_2 > NO$.

Q. Incorrect order of basic character.

(a) Ag_2O (Basic) > PbO (amphoteric) (b) HgO (Basic) > ZnO (ampho) (c) Fe_2O_3 (Basic) > Al_2O_3 (ampho.) ~~(d) $Ag_2O > CuO$.~~

– In case of d block cation, charge density ↑es down the group.
but neutral d block, charge density ↓es down the group.

Cu^+, Ag^+, Zn^{+2}, Cd^{2+}, Hg^{+2} | charge density ↓es, Basic character ↑es.

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→ Basic character → Ag_2O Cu_2O Au_2O

↳ $Cu_2O > Ag_2O > Au_2O$.

Q. Correct order of B. strength?

(a) $BaO < NiO$ (b) $CaO < ZnO$ (c) $FeO < Fe_2O_3$ (d) $Na_2O < K_2$

- S-block oxide is more basic than d-block oxide.
- All s-block metal oxide are basic in nature except BeO (amphoteric)

$$BeO + HCl \longrightarrow BeCl_2 + H_2O$$

$$BeO + NaOH \longrightarrow Na_2BeO_2 + H_2O$$

Sod. Beryllate (soluble salt)

- All p-block non-metal oxides are acidic in nature due to their predominantly covalent character. Few of them are neutral oxide also.

↳ eg. N_2O, NO, CO, & H_2O (amphoteric)

(Neutral)

- All d-block metal oxides are basic in, amphoteric or acidi in nature depending on oxidn state of d block metal. (Transition metal).

+ve. O.S of d-block cation	Nature of oxide
+1, +2, +3	Basic in nature except Cr_2O_3 amphoteric.
+4	amphoteric oxide
+5, +6, +7	acidic oxide except V_2O_5 amphoteric.

→ $\overset{+2}{MnO}$ (Basic) $\overset{+4}{MnO_2}$ (Amphoteric) $\overset{+7}{Mn_2O_7}$ (Acidic)

Q. $\overset{+2}{CrO}$ (basic) $\overset{+3}{Cr_2O_3}$ (amphoteric) $\overset{+6}{CrO_3}$ (acidic.)

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- All possible oxides of amphoteric metal.
[Zn, Al, Be, Pb, Sn & Ga]

Amphoteric metal	Possible oxide / Hydroxide
Zn	ZnO / $Zn(OH)_2$
Al	Al_2O_3 / $Al(OH)_3$
Be	BeO / $Be(OH)_2$
Pb	$\overset{+2}{Pb}O$ / $\overset{+4}{Pb}O_2$
Sn	$\overset{+2}{Sn}O$ / $\overset{+4}{Sn}O_2$
Ga	$\overset{+1}{Ga_2}O$ / $\overset{+3}{Ga_2}O_3$ & HgO also.

- $Zn + 2HCl \longrightarrow ZnCl_2 + H_2\uparrow$
- $Zn + NaOH \longrightarrow Na_2ZnO_2 + H_2\uparrow$
Sod. zincate

→ $\overset{+2}{Pb}O > \overset{+4}{Pb}O_2$ — Basicity — less basic, so, more reactive towards base.

more basic
so, more reactive towards acidx